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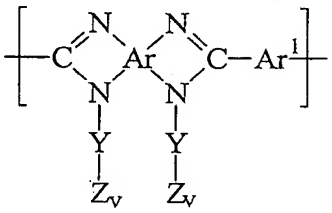
PCT/EP2003/007020
JT12 Rec'd PCT/PTO 05 JAN 2005

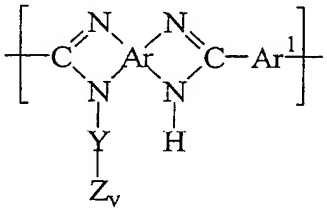
Claims:

1. A functionalized polyazole comprising recurring imidazole units of the general formula



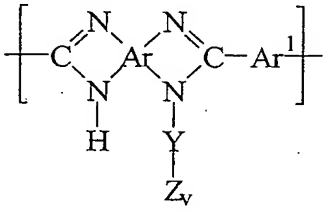
(1a)

and/or



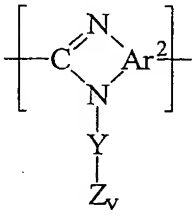
(1b)

and/ or



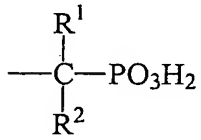
(1c)

and/or



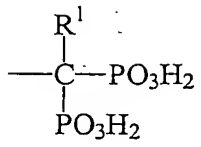
(2),

where the radicals Ar, Ar^1 and Ar^2 are tetravalent, divalent or trivalent aromatic or heteroaromatic groups,
Y is a bond or a group having from 1 to 20 carbon atoms,
v is an integer from 1 to 10 and
Z is a group of the general formula



(3)

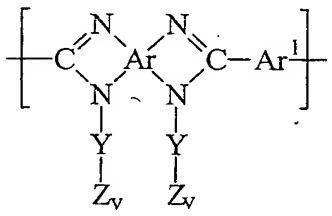
or



(4),

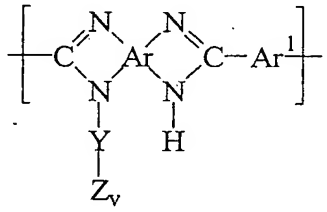
where R^1 and R^2 are each, independently of one another, a hydrogen atom or a group having from 1 to 20 carbon atoms, characterized in that the solubility of the polyazole in N,N-dimethylacetamide is at least 0.1 g, based on 100 g of solution, at 100°C.

2. A functionalized polyazole comprising recurring imidazole units of the general formula



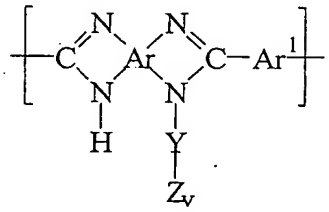
(1a)

and/or



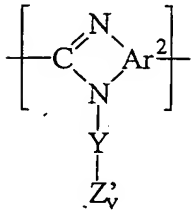
(1b)

and/ or



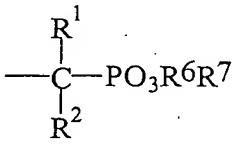
(1c)

and/or



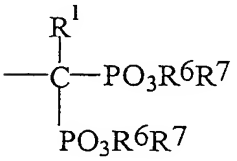
(2'),

where the radicals Ar, Ar^1 and Ar^2 are tetravalent, divalent or trivalent aromatic or heteroaromatic groups,
Y is a bond or a group having from 1 to 20 carbon atoms,
v is an integer from 1 to 10 and
Z' is a group of the general formula



(3')

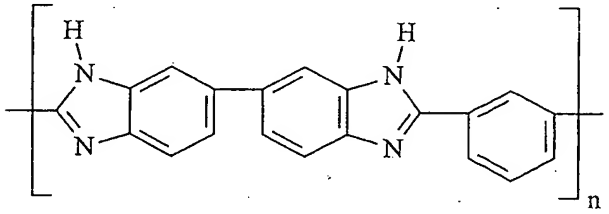
or



(4'),

where R^1 and R^2 are each, independently of one another, a hydrogen atom or a group having from 1 to 20 carbon atoms and R^6 and R^7 are each, independently of one another, a group having from 1 to 20 carbon atoms.

3. The polyazole as claimed in claim 1 or 2, characterized in that the polymer comprises recurring benzimidazole units of the formula (5a):



(5a),

where n is an integer greater than or equal to 10.

4. The polyazole as claimed in one or more of the preceding claims, characterized in that it is doped with an acid.

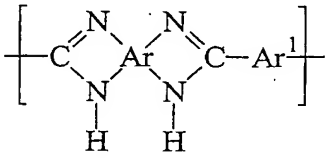
5. The polyazole as claimed in claim 4, characterized in that the degree of doping, expressed as mole of acid per mole of repeating units of the polymer, is from 3 to 15.

6. The polyazole as claimed in one or more of the preceding claims, characterized in that the group Y is a radical having 1 or 2 carbon atoms.

7. The polyazole as claimed in one or more of the preceding claims, characterized in that it has a molar ratio of phosphorus to nitrogen, P/N, measured by means of elemental analysis in the range from 0.02 to 0.5.

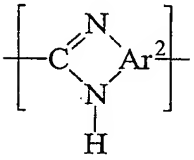
8. A process for preparing functionalized polyazoles as claimed in one or more of claims 2 to 7, characterized in that

A) a polymer comprising recurring imidazole units of the general formula



(5)

and/or

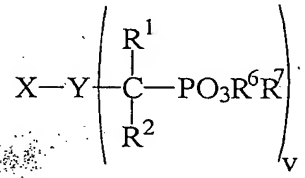


(6)

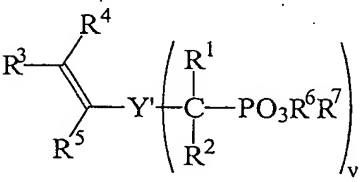
is dissolved in a solvent,

B) this solution is reacted with a base and deprotonated in this way,

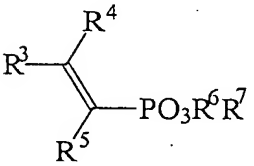
C) the solution from step B) is reacted with at least one phosphonate of the general formulae



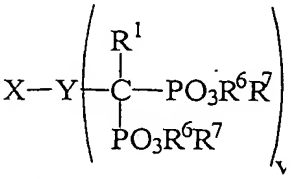
(7),



(8),

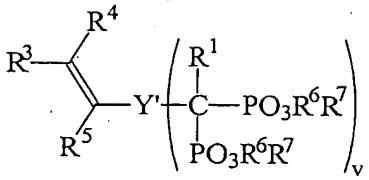


(9),



(10),

and/or



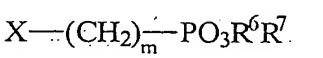
(11),

where R^3, R^4 and R^5 are each, independently of one another, a hydrogen atom or a group having from 1 to 20 carbon atoms,
R^6 and R^7 are each, independently of one another, a group having from 1 to 20 carbon atoms,
X is a leaving group and
Y' is a bond or a group having from 1 to 20 carbon atoms.

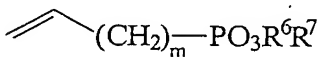
9. The process as claimed in claim 8 for preparing functionalized polyazoles as claimed in one or more of claims 1 and 3 to 7, characterized in that the solution resulting from C) is acidified with an acid.

10. The process as claimed in any of the preceding claims, characterized in that a base having a pK_B at 25°C of less than 7, preferably less than 6, in particular less than 5, is used in step A).

11. The process as claimed in any of the preceding claims, characterized in that phosphonates of the general formulae



(7a)



(8a)

where m is an integer from 0 to 11 and the radicals X, R^6 and R^7 are as defined above, is used as phosphonate in step B).

12. A polyazole obtainable by a process as claimed in claim 9.

13. A polymer electrolyte membrane coated with polyazoles as claimed in at least one of claims 1 to 7 and 12.

14. A polymer electrolyte membrane comprising polyazoles as claimed in at least one of claims 1 to 7 and 12.

15. A membrane-electrode unit comprising a polymer electrolyte membrane as claimed in claim 13 or 14.

Amended sheets

16. A membrane-electrode unit comprising ionomers based on polyazoles as claimed in at least one of claims 1 to 7 and 12.

17. A fuel cell comprising a membrane-electrode unit as claimed in claim 15 or 16.